Exhibit A (6 pages)

Disclosure ARC8-2000-0324

Created By: Jordan A Katine **Created On:** 10/16/2000 11:03:21 AM
Last Modified By: Jordan A Katine **Last Modified On:** 10/18/2000 10:31:35 AM

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Summary

Status	Under Evaluation
Processing Location	ARC
Functional Area	XTIA - Recording Heads Technology - (Bob Scranton)
Attorney/Patent Professional	Thomas Berthold/Almaden/IBM
IDT Team	Thomas Berthold/Almaden/IBM
Submitted Date	10/16/2000 11:22:45 AM
Owning Division	RES
PVT Score	To calculate a PVT score, use the 'Calculate PVT' button.
Incentive Program	
Lab	
Technology Code	

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IDT Selection

IDT Team:	Attorney/Patent Professional:
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Response Due to IP&L : 11/17/2000

Main Idea

Title of disclosure (in English)

Fully Undercut Resist Systems Using E-Beam Lithography for the Fabrication of High Resolution MR Sensors

Idea of disclosure

1. Describe your invention, stating the problem solved (if appropriate), and indicating the advantages of using the invention.

In today's photolithographically-defined contiguous junction hard bias MR sensors, an undercut resist scheme is necessary for the formation of high quality junctions. As the areal density of MR recording continues to climb, we will soon reach trackwidths so narrow that fabricating a controlled undercut resist pedestal becomes intractable. It is, however, possible to use a suspended resist bridge in a combined milling and liftoff process to define narrow trackwidth MR sensors. This disclosure describes how e-beam lithography can be combined with different multilayer resist schemes to obtain fully undercut, narrow resist bridges to be used in the fabrication of MR sensors.

2. How does the invention solve the problem or achieve an advantage,(a description of "the invention", including figures inline as appropriate)?

Today's best magnetoresistive sensors are fabricated using an optical lithography, bilayer resist pedestal technique illustrated in Fig. 1.

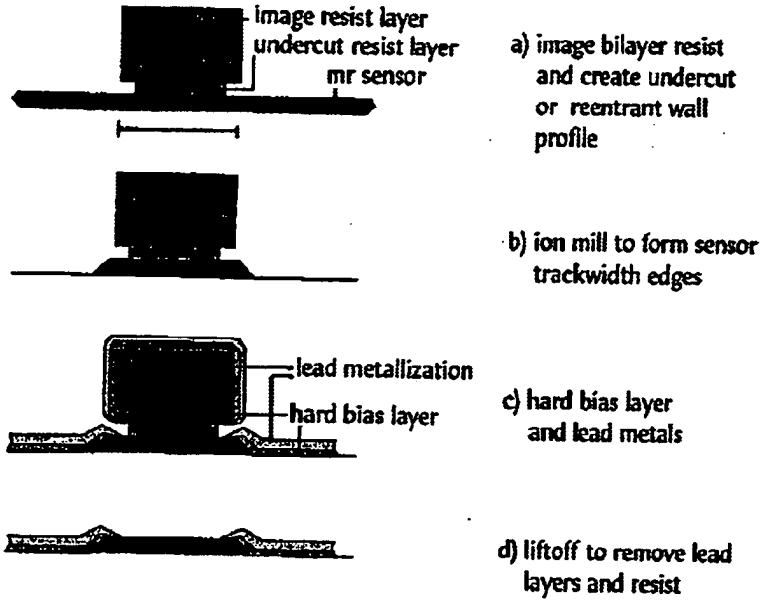

Figure 1. Bi-layer Resist Processing for MR Sensors

The photoresist masks the active sensor region during an ion milling step, and then serves as a liftoff mask for depositing the hardbias and leads that contact the edges of the sensor. The undercut nature of the bilayer resist structure facilitates liftoff of the hardbias and leads. The undercut also allows superior junctions to be formed between the hardbias and the sensor (by

minimizing shadowing effects from hardbias material deposited onto the resist sidewalls and by eliminating the redeposition of milled material onto the resist sidewalls). In order to achieve higher areal densities in magnetic recording, e-beam lithography will likely be used to achieve the future linewidth resolution required for MR sensor trackwidth. Undercut resist systems compatible with e-beam resist chemistry will be required to form these MR sensors. Consider, though, that these trackwidths will be narrower than 0.2 μm. These trackwidths are so narrow that continuing with the present bilayer resist pedestal approach would require the amount of undercut to be signficantly reduced, which would adversely affect the liftoff processing. In addition, attempting to control the precision of the undercut to hundreths of a micron would be extremely challenging.

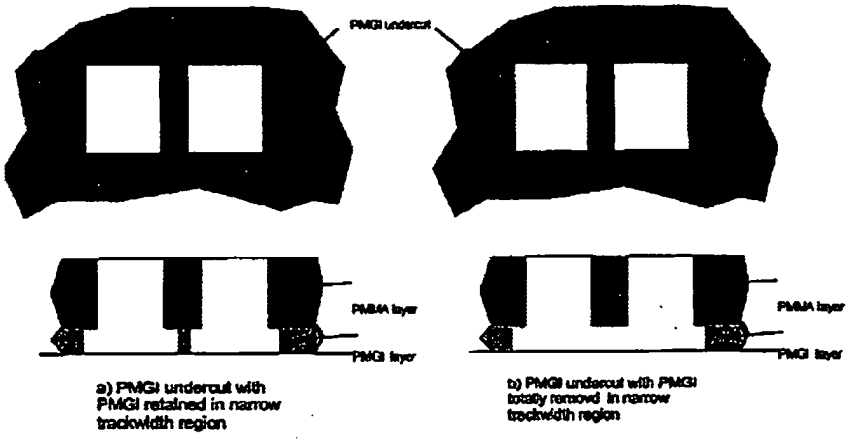

Figure 2. PMMA / PMGI Undercut Resist Structure with PMGI Removed in Critical Trackwidth Region

Considering the aforementioned limitations of the present bilayer pedestal approach at narrow trackwidths, it is prudent to consider alternative processing techniques. One promising approach is the use of a suspended resist bridge. Suspended resist bridge technology was developed for defining tunnel junctions (G.J. Dolan, "Offset Masks for Lift-off Photoprocessing, Appl. Phys. Lett. 31, 337 (1977)), but could prove very useful for defining MR sensors. A fully suspended bridge provides the maximum amount of undercut possible for a given trackwidth. In addition, the fully suspended bridge does not require the processing precision required for defining a controlled pedestal undercut. The literature contains several techniques for creating a fully suspended e-beam resist bridges. We have had good results using two polymer layers, with only the top polymer layer being sensitive to e-beam exposure and to the e-beam developer. Specifically, we have used PMMA as the top polymer and PMGI as the bottom polymer. Exposed PMMA dissolves in a solution of IPA and water. PMGI is not affected by this solution whether or not the PMGI has been exposed to e-beam energies. PMGI dissolves in a basic developer having concentrations of NaOH or KOH. PMMA is not affected by this basic solution. This set of chemistries allows us to e-beam expose and develop the top PMMA layer without attacking the bottom PMGI layer and allows us to dissolve the bottom PMGI layer

without attacking the edges of the PMMA walls. This process sequence is illustrated in Figure 2. The sequence starts with the spinning of a PMGI layer and then a PMMA layer. The trackwidth image is exposed by e-beam and then the PMMA is developed in IPA and water. The IPA/Water solution removes the exposed PMMA but not the underlaying PMGI material. Then the resist structure is placed in a basic solution like NaOH and water. Here the PMGI is dissolved and then with additional time in the basic solution the PMGI undercuts the PMMA wall edges. The basic solution does not attack the edges of the developed PMMA so a dimensionally stable undercut bridge structure results. The results of this work are illustrated in Figure 3, where MR sensor trackwidths have been formed using a PMMA/PMGI bilayer and e-beam lithography. Although a positive e-beam resist (PMMA) was used in this example, negative e-beam resists may also be used for creating suspended bridges suitable for lithographically patterning MR sensor.

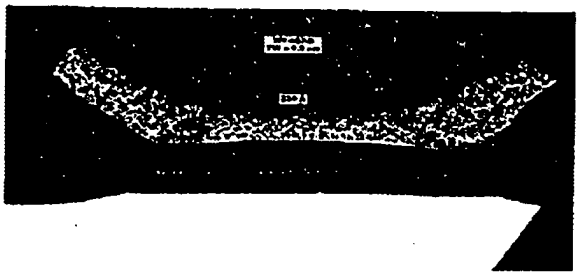

Figure 3. TEM Cross-section of Sensor Fabricated Using Suspended PMMA Bridge

3. If the same advantage or problem has been identified by others (inside/outside IBM), how have those others solved it and does your solution differ and why is it better?
Not to our knowledge

4. If the invention is implemented in a product or prototype, include technical details, purpose, disclosure details to others and the date of that implementation.
No

*Critical Questions (Questions 1 - 7 must be answered)

*Question 1 On what date was the invention workable? 09/15/2000 Please format the date as MM/DD/YYYY (Workable means i.e. when you know that your design will solve the problem)	
*Question 2 Is there any planned or actual publication or disclosure of your invention to anyone outside IBM?	○ Yes ● No
If yes, Enter the name of each publication or patent and the date published below. Publication/Patent: Date Published or Issued:	
Are you aware of any publications, products or patents that relate to this invention?	● Yes ○ No

If yes, Enter the name of each publication or patent and the date published below.
Publication/Patent: G.J. Dolan, "Offset Masks for Lift-off Photoprocessing, Appl. Phys. Lett. 31, 337 (1977)),
Date Published or Issued:

*Question 3
Has the subject matter of the invention or a product incorporating the invention been sold, used internally in manufacturing, announced for sale, or included in a proposal? ○ Yes ● No
Is a sale, use in manufacturing, product announcement, or proposal planned? ○ Yes ● No
If Yes, identify the product, if known, and indicate the date or planned date of sale, announcements, or proposal and to whom the sale, announcement or proposal has been or will be made.
Product:
Version/Release:
Code Name:
Date:
To Whom:
If more than one, use cut and paste and append as necessary in the field provided.

*Question 4
Was the subject matter of your invention or a product incorporating your invention used in public, e.g., outside IBM or in the presence of non-IBMers? ○ Yes ● No
If yes, give a date. Please format the date as MM/DD/YYYY

*Question 5
Have you ever discussed your invention with others not employed at IBM? ○ Yes ● No
If yes, identify individuals and date discussed. Fill in the text area with the following information, the names of the individuals, the employer, date discussed, under CDA, and CDA #.

*Question 6
Was the invention, in any way, started or developed under a government contract or project? ○ Yes ● No ○ Not sure
If Yes, enter the contract number

*Question 7
Was the invention made in the course of any alliance, joint development or other contract activities? ○ Yes ● No ○ Not Sure
If Yes, enter the following: Name of Alliance, Contractor or Joint Developer
Contract ID number
Relationship contact name
Relationship contact Email
Relationship contact phone

Question 8
Have you submitted, or are you aware of, any related disclosure submission? ○ Yes ● No
If Yes, please provide the title and docket or disclosure number below:

Question 9
What type of companies do you expect to compete with inventions of this type? *Check all that*

apply:

- [ ] Manufacturers of enterprise servers
- [ ] Manufacturers of entry servers
- [ ] Manufacturers of workstations
- [ ] Manufacturers of PC's
- [ ] Non-computer manufacturers
- [ ] Developers of operating systems
- [ ] Developers of networking software
- [ ] Developers of application software
- [ ] Integrated solution providers
- [ ] Service providers
- [x] Other (Please specify below):

Manufacturers of thin film reading heads

Patent Value Tool (Optional - this may be used by the inventor and attorney to assist with the evalua

(The Patent Value tool can be used by you or the evaluation team to determine the potential licensing value of your invention.)

The Patent Value Tool has not yet been used to calculate a score.

Post Disclosure Text & Drawings
Enter any additional information relating to this disclosure below:

(Form Revised 12/17/97)